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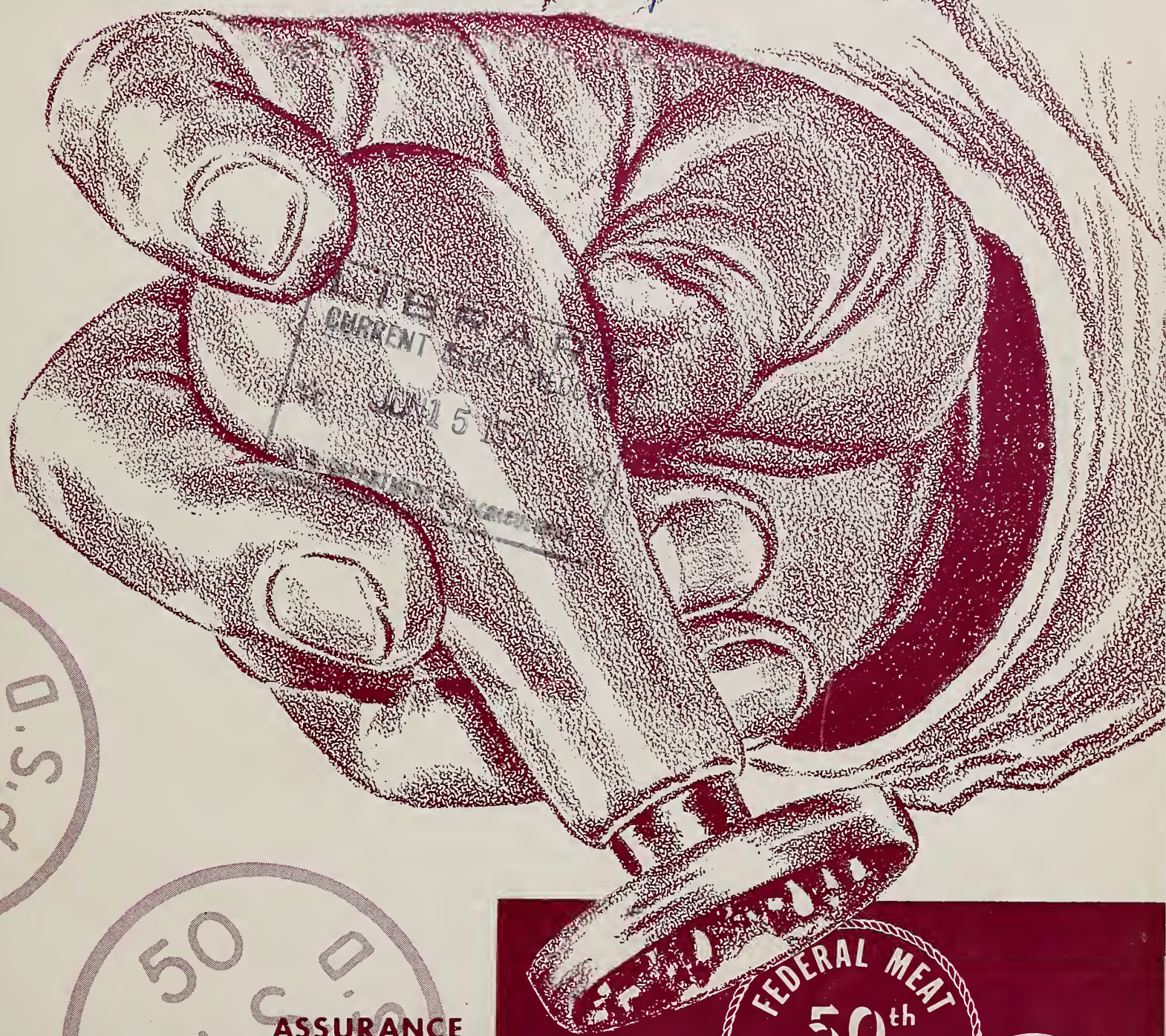
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# AGRICULTURAL Research

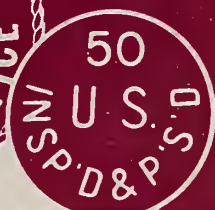
JUNE 1956



ASSURANCE

see page 7

UNITED STATES DEPARTMENT OF AGRICULTURE



# AGRICULTURAL Research

Vol. 4—June 1956—No. 12

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## Preparedness

We ordinarily think of agricultural research and related regulatory and service activities as essentially peaceful pursuits. They are. But the work we do also makes big contributions to our national strength and military capacity.

Your first thought may be of our contributions to special needs of the Armed Forces—like dextran blood-plasma substitute. This fluid, made from corn sugar, first went to war in Korea and can save thousands of lives in an emergency.

Or perhaps you're familiar with our work in converting perishable foods into palatable and nutritious forms that need a minimum of shipping and storage space and keep well through long storage, often under adverse conditions.

If you handle a regulatory job, you may be thinking about our contributions to protecting agriculture from the hazards of biological warfare and other types of attack. Our livestock and crops would undoubtedly be a target for such warfare.

Animal diseases can move with lightning speed. An outbreak in Oregon could—unless detected and stopped in our web of transportation—be in a Florida barnyard in a few days. Plant diseases and insect pests offer similar problems.

So regulatory activities are part of our basic line of defense. We must be ready to expand peacetime operations.

Broadest of all are our contributions to making agriculture efficient, prosperous, and capable of producing all the country needs with the least strain on our resources.

Right now, of course, we're concerned with helping ease the cost-price squeeze and surplus problems that are bearing down on farmers. But our research findings will also have a bearing on future military planning. For example, if farmers learn to make more efficient use of fertilizers, perhaps some of the potential competition for sulfuric acid can be reduced.

Today, a United States farmworker produces enough for himself and 18 others. This efficiency made possible by science gives us a big advantage over countries that must use 50 to 60 percent of their manpower to provide essential food needs.

The fact is that our work benefits the whole country and helps keep us ready for whatever comes—peace or war.

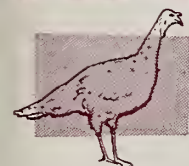
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AGRICULTURAL RESEARCH SERVICE  
United States Department of Agriculture



**poultry**

**TURKEY HENS** used at Beltsville in studies of parthenogenesis were kept three ways: (1) with male birds in view in nearby pen—at far left, background; (2) with sterilized males in pen—foreground, far left; (3) out of contact with each other and out of sight and hearing of males—left. Incidence of parthenogenesis wasn't significantly different.



## Low Fertility and Hatchability—WHY?

**BELTSVILLE'S PARTHENOGENETIC POULTS POINT UP THIS SERIOUS PROBLEM OF THE TURKEY INDUSTRY**

**U**SDA poultry scientists are continuing their efforts to find reasons for low fertility and hatchability in turkey eggs—without the help of the two parthenogenetic poults hatched at Beltsville this spring.

These were the first poults to hatch from infertile eggs and live more than a few hours. One of the birds survived for 22 days, the other for 18.

Observations on parthenogenesis already made by poultry husbandmen M. V. Olsen and S. J. Marsden form only one phase of the research they are conducting on the basic facts for improving fertility and hatchability of turkey eggs. Loss of the poults will not delay the researchers' work.

Low fertility and hatchability in turkey eggs have long been a problem of the industry. Early in the mating season, there is little difference between chicken and turkey eggs in fertility and hatchability. In fact, at that time, fertility may average a little higher in turkey eggs. But turkey-egg fertility falls off rapidly as the molting season approaches.

At the start of breeding season, breeders often use artificial light to lengthen the days and thus stimulate egg production. The light also has a stimulating effect on the male birds.

But too much light causes early molt—a condition that upsets the endocrine system of a male bird and reduces his ability to fertilize eggs.

In contrast to fertility, hatchability of turkey eggs seems to depend more on the female birds than the males. Good hatchability, based on a given number of truly fertile eggs, apparently ties in with good breeding, adequate feed, and with good physical condition of the turkey hens.

The incubation tests being continued will make use of eggs produced by mated hens, in contrast to the tests for parthenogenesis that were made with eggs from unmated hens.

**The extent of** parthenogenetic development in infertile eggs from mated flocks is not well known. But in previous incubation tests, Olsen and Marsden found about the same incidence of parthenogenesis in eggs from mated hens as in eggs from unmated hens. So the researchers hope to find the degree to which parthenogenesis is mistaken for true fertility.

Even though true fertility may be high, parthenogenesis occurs often enough in eggs from mated hens to sometimes indicate greater true fertility than is actually the case. Turkey eggs are purchased by hatchery-



**ONE OF TWO** poults hatched from infertile eggs at Agricultural Research Center is fed by M. W. Olsen. This one survived 22 days, the other 18. They're the first parthenogenetic poults to live more than a few hours.

men on the basis of fertility as determined by candling the eggs under incubation. Findings may demonstrate the feasibility of changing from this method to the purchasing of eggs on the basis of hatchability.

By either candling or breaking out all eggs at various stages of the incubation period, Olsen will be able to determine those eggs having (1) good germs, (2) dead germs, (3) parthenogenetic development, and (4) normal, uncomplicated infertility.

**These tests will** give the researchers greater knowledge of the frequency of parthenogenesis in mated flocks at various seasons, as well as highs and lows in the fertility-hatchability scale according to season.☆



## Proved sires and artificial breeding go together

■ DAIRY HERD IMPROVEMENT in milk and butterfat producing efficiency is being accelerated nationally through the growing use of proved sires.

Most noteworthy is the improvement shown in the many herds maintained in the United States by means of artificial breeding, according to J. F. Kendrick, USDA head of Dairy Herd Improvement Association work.

Such herds now total about 25 percent of all our dairy cows.

Of a total of 2,450 sires used in the artificial breeding of 5,413,847 dairy cows in 1955—an alltime record—883 were proved sires. These sires were selected from DHIA herds on the basis of the individual performance of their nonselected daughters as compared with the production of each daughter's dam.

In 1955, for example, daughters of the 883 proved sires used in artificial breeding produced an average of 11,265 pounds of milk and 476 pounds of butterfat, against 10,575 pounds of milk and 436 pounds of fat for the daughters' dams during the year.

In 1943—the first year proved sires were used for artificial breeding—average daughter production was 10,155 pounds of milk and 419 pounds of butterfat, compared with dam production of 9,559 pounds of milk and 387 pounds of butterfat.

"Actually, for the last 3 years," says Kendrick, "an average of more than 36 percent of the bulls used by State, cooperative, and privately owned breeding units in this country have been proved sires. All these

have been selected by operators of the breeding units largely on the basis of records supplied by DHIA. Sire proving became a part of the DHIA program in 1935, the 50,000th bull having been proved last August (AGR. RES., October 1954, p. 15).

The record number of more than 1,500 artificial-breeding organizations in the United States on January 1, 1956, indicates the expansion of artificial breeding in 16 years (AGR. RES., February 1954, p. 13).

These units, operating in nearly every State, and in Alaska, Puerto Rico, and Hawaii as well, have a total enrollment this year of 661,497 dairy herds. This is more than 100 times the number of herds enrolled in 1939, first year the program was in operation. Last year, there were 24 States with 50,000 or more dairy cattle artificially bred. Wisconsin again topped the list with 1,000,293 head, and Minnesota, Pennsylvania, and New York each reported well over 425,000 artificially bred cows.☆

## Income increases on family-size dairy farms in Northeast

■ NORTHEASTERN FAMILY-SIZE dairy farms had a one-fourth larger net farm income and a one-third larger net cash farm income last year than in 1950, a USDA survey shows.

Net farm income was \$4,433 and net cash farm income \$2,803 on the average last year. They were \$3,539 and \$2,054, respectively, in 1950.

Total cash receipts were up 17 percent in 1955—averaged \$8,753 compared with \$7,463 in the earlier year—but expenses rose only 10 percent. The return of \$3,033 to the operator and family labor also meant 17 percent more real buying power.

The average scale of operations has been increasing gradually. Last year the farms averaged 201 acres,

with 38.4 total head of cattle, and 23.4 heifers and cows aged 2 years or older. That compared with 191 acres, 34 head of cattle, and 22.4 cows and heifers in 1950. These increases partly account for the larger income. An important factor, however, was greater operating efficiency that enabled the dairymen to reduce hired-labor cost 38 percent.

In the last 5 years, the average size of dairy herds on these farms increased 14 percent, and milk production went up 21 percent. Average price of milk sold increased from \$4.06 to \$4.40 per hundredweight.☆

## New cheese method works with industry's regular equipment

■ A TIME AND LABOR-**SAVING** method of making Cheddar cheese has now been improved by its originators—USDA researchers at the Agricultural Research Center, Beltsville, Md.

Dairy technologist H. E. Walter will explain the process at the American Dairy Science Association annual meeting June 19–21, at the University of Connecticut, Storrs.

The method was developed and first described in 1953. But it has since been further improved and modified for use with the industry's conventional cheesemaking equipment.

The method, as originally devised by Walter and ARS coworkers A. M. Sadler, J. P. Malkames, and C. D. Mitchell, reduces by fully half the normal time of 6 to 7 hours required by commercial makers to prepare this widely favored cheese.

As modified, the method has been used successfully on a pilot-plant scale by the researchers and is now ready to undergo commercial trial.

A full report will be made on the new process at the 14th International Dairy Congress, to be held at Rome, Italy, September 24–28.☆

# PARALLEL TERRACES PAY



crops  
and soils

**They make land easier to farm than the irregular type of terracing**

■ PARALLEL TERRACES may be one way to control soil erosion on sloping land without some of the complications of the usual kind of terraces where row crops are to be grown.

The difficulty of farming terraced land keeps some farmers from protecting their sloping fields from erosion. The trouble is that when terraces are fitted to the natural contour of the land, they're frequently irregular in curvature and don't parallel each other. That means point rows. More time is spent in turning around and less time in farming.

Cooperative research by USDA and the Missouri and Alabama experiment stations showed it's practical to lay out substantially parallel terraces. That cuts farming time. The studies were made at the Midwest Claypan Experiment Station, McCredie, Mo., and the experiment station at Auburn, Ala. The new plan was tried out with corn, soybeans, and cotton as the tilled crops. Runoff and erosion control was satisfactory.

ARS agricultural engineer D. D. Smith and his associates at McCredie found that terraces parallel to each other reduced point-row area 70 percent and nearly doubled average row length. It cut operator time in the field with tractor and equipment about 10 percent. Time for all operations in growing corn—that is, plowing the land to shredding the stalks—was 5.33 hours per acre with the old terraces and 4.38 hours after parallelizing. It cost about \$21 per acre to reconstruct terraces, and Smith finds that time savings under the parallelized system will repay the cost of reconstruction in about 7 years.

It isn't always practical to have all terraces parallel to each other in a large field with irregular slopes. That problem can be met and point rows avoided by using two or more terrace systems, each parallel within itself. Irregular extra spaces between nonparallel systems should go into grass, as should practically all natural waterways in the field.

In some places irregularities of slope in a field can be minimized enough for parallel terraces by land forming with a bulldozer or land leveler. This leaves somewhat more area of subsoil exposed than in the conventional system. Good farming practice, however, will largely overcome that problem before long. Smith found that corn yield last year—fourth year after reconstructing the terraces at McCredie—was only 7 percent lower on exposed subsoil than on the rest of the field.

Since crop rows parallel the terraces and there are few point rows, it's possible to space the terraces for multiples of 2 or 4 rows to fit the machinery used on the farm.

**Laying out a field** for parallel terraces calls for a competent engineer. It takes careful study of the field. Technicians assigned to work with the Soil Conservation Districts can supply the engineering assistance needed to lay out this improved water management system.★

## WHEN WATER DOES MOST FOR TOBACCO AND CORN

■ Irrigating tobacco and corn at critical growth periods raised yields almost as much as all-season irrigation in tests at Blacksburg, Va.

Cooperative research by USDA and the Virginia experiment station showed that Burley tobacco irrigated during its most rapid growth—from knee-high to bloom stage—yielded just as much in 1954 and 1955 as tobacco under full-season irrigation. The more limited irrigation took less water—2 inches less the first year and 4.6 inches less the second.

Corn yielded best when soil moisture was kept abundant throughout the season. But corn likewise gave the most efficient return for the amount of water supplied when irrigated during its critical period—from tasseling through the milk stage. Corn yielded 115 and 128 bushels per acre under full-season irrigation in 1954 and 1955, respectively, and 102 and 104 bushels when supplied only a third to a half as much irrigation water but applied during corn's period of greatest need. Thus, all-season

irrigation gave 6.1 and 3.4 extra bushels of corn per inch of water applied. Critical-period irrigation, on the other hand, gave 12.6 and 4.3 bushels per inch for the 1954 and 1955 seasons, respectively.

In the full-season irrigation test, water was applied by sprinklers when moisture, available to the plant roots from the top 18 inches of soil, was reduced 50 percent below soil moisture capacity. This was done only during the critical growth periods in the modified-irrigation plots.★



**MONOGERM SELECTIONS** cross-pollinate in test of progeny to locate best mother plants. Bagged flowers self-fertilize—keep line pure for possible use to breed hybrid seed. Seedlings (right) show how monogerm seed ends hand thinning of plant clusters from multigerm seed.

## Taking the Stoop out of Beet Farming

**WITH MONOGERM VARIETIES  
AND NEW EQUIPMENT, SUGAR  
BEETS ARE MOVING TOWARD  
FULL FIELD MECHANIZATION**



**T**HE RISE of the sugar beet as an important source of food almost parallels the general rise of interest in scientific agriculture.

Recent improvements in varieties, yield of roots, and mechanical harvesting indicate a surprising spurt in results after more than 100 years of research in Europe and, more recently, the United States.

What has been accomplished here in the last few years was brought out at a recent meeting of the American Association of Sugar Beet Technologists, at San Francisco. Among those attending was USDA agronomist Dewey Stewart, in charge of ARS sugar-beet breeding. "The highlight there," he says, "was enthusiasm over the new monogerm, disease-resistant, big-tonnage, high-sugar hybrid variety developed by the Department

and its agents, supported by the Beet Sugar Development Foundation."

A sugar beet with monogerm seeds (one seed to each seed ball) had long been sought as a way to cut down hand labor in thinning excess plants in the fields and to simplify weeding. Such a plant was found in a hybrid (Michigan 18) in 1948 by V. F. Savitsky, geneticist with the foundation and a collaborator with USDA.

**Designated SLC 101**, this scrawny plant was anything but the sort of beet likely to please a farmer. In the hands of breeders, however, SLC 101 contributed its valuable monogerm character to varieties prized in various areas because of other valuable qualities such as yield, disease resistance, and adaptation.

The scientists and technicians at the San Francisco meeting congratu-

lated each other not only because the sugar-beet industry had arrived at a new high point of efficiency but also because they could anticipate rapid improvement in varieties and in complete field mechanization.

The laborsaving promise of monogerm beets lies in the fact that they permit the spacing of seeds to give hills single plants rather than clumps of plants. This makes machine thinning and weeding feasible.

With the old multigerm seed, the spring operations of thinning and weeding had to be done by hand. That made sugar beets a high-labor crop, dependent on migratory workers. Stewart says there is no doubt these jobs will soon be done with mechanical thinners or stand reducers, developed from the cotton chopper.

**Harvesters that lift** the beets and put them on trucks also make it possible for a farmer, with his family or local labor, to harvest his crop. He will no longer have to depend on itinerant labor at any stage.

Monogerm seed supplies are becoming available for field testing and increase in a few sugar-beet districts of various climatic areas. For some districts, says Stewart, there are now experimental monogerm varieties that do as well as the best of the multigerms. These new ones are hybrids and are high yielders.

This breeding work has moved rapidly because disease-resistant strains of the old adapted varieties can be used as male parents in the production of hybrid monogerm seed. Seed balls from the multigerm pollenizers, being larger than the others, can be screened out or those plants destroyed before maturing seed.

So it's now clear that our best varieties are not to be lost. They can be combined with monogerm plants to produce varieties that give good yields of high-sugar beets with half the labor required for thinning before the discovery of SLC 101.★



# THE LITTLE PURPLE STAMP

## FEDERAL MEAT INSPECTION WHO BENEFITS



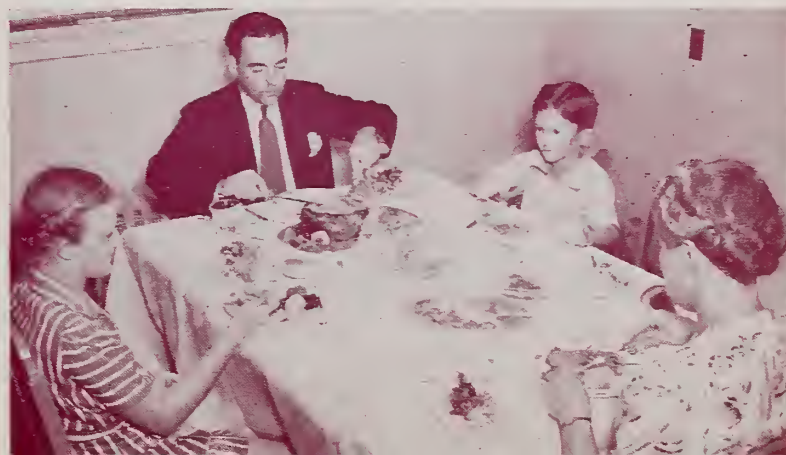
**FARMERS** gain through higher returns from healthier livestock and through steady consumer demand for the most important farm product.



**PACKERS** benefit from consumer confidence in meat, also through reduction of losses from diseased animals and unsanitary conditions.



**CONSUMERS** get better nutrition and health protection as a result of inspection. Low packer's losses help consumer's pocketbook too.



**This is the confidence-inspiring symbol of Federal meat inspection which is 50 years old this month**

**T**HIS YEAR marks the 50th anniversary of USDA's meat-inspection service—the service popularly symbolized by the purple stamp of approval “U. S. INSP'D & P'S'D” seen on larger cuts of meat in the market.

“Half a century in which the Federal Government has worked together with farmers, meatpackers, and processors to assure our people a supply of meat that is clean, wholesome, and truthfully labeled”—that's how A. R. Miller, who heads up ARS meat inspection, thinks of it.

The entire livestock industry as well as the meat-eating public has benefited from this cooperative effort. Witness the big growth of the industry—a product valued at over \$12 billion a year, the second-ranking industry of the country in dollar value. The current output of meat is about 25 billion pounds a year. Of this, almost 80 percent is marketed with the Federal stamp of approval. That's the largest the figure has ever been.

Confidence of the public in the handling of this nutritionally vital food is reflected in our country's high consumption of meat—161 pounds per person in 1955.

**There was no such confidence** in June 1906 when Congress passed the first comprehensive Meat Inspection Act, at the urging of President Theodore Roosevelt. The act was prompted by the report of a special committee that had been appointed—in response to public sentiment—to study conditions in meat industry.

The law of 1906 provided for Federal inspection of meat and meat food products as well as supervision of



## FEDERAL MEAT INSPECTION HOW IT WORKS

meat preparation and labeling and conditions under which meat is slaughtered and processed. It applied to establishments that sold any part of their product in interstate or foreign trade. A prior law, dating from 1890, had limited inspection to meat for export.

Except for minor changes, the basic law has been found good and is the same as in 1906. Only the facilities for securing "a clean and wholesome meat supply" have changed to keep up with new developments.

**Work of the meat-inspection service** may be summarized as: (1) supervision of the sanitation of plants; (2) inspection of animals before slaughter to eliminate those unfit for food; (3) careful examination of the head, glands, internal organs, and carcass of each animal immediately after slaughter; (4) inspection of processing, such as curing, canning, freezing of meat, making sausages and similar products; (5) disposal of condemned

**4.** Condemned meat is destroyed under the supervision of the Federal inspector. It is usually placed in special steam pressure tanks and made into fertilizer or inedible grease. Until it's disposed of, condemned meat is kept in a locked room in custody of the inspector.



**1.** Construction specialist checks plumbing of new canning plant. To qualify for Federal inspection, slaughtering and processing plants must be built so that they can be kept clean. Requirements include ample hot water under pressure, good drainage, lighting, ventilation.



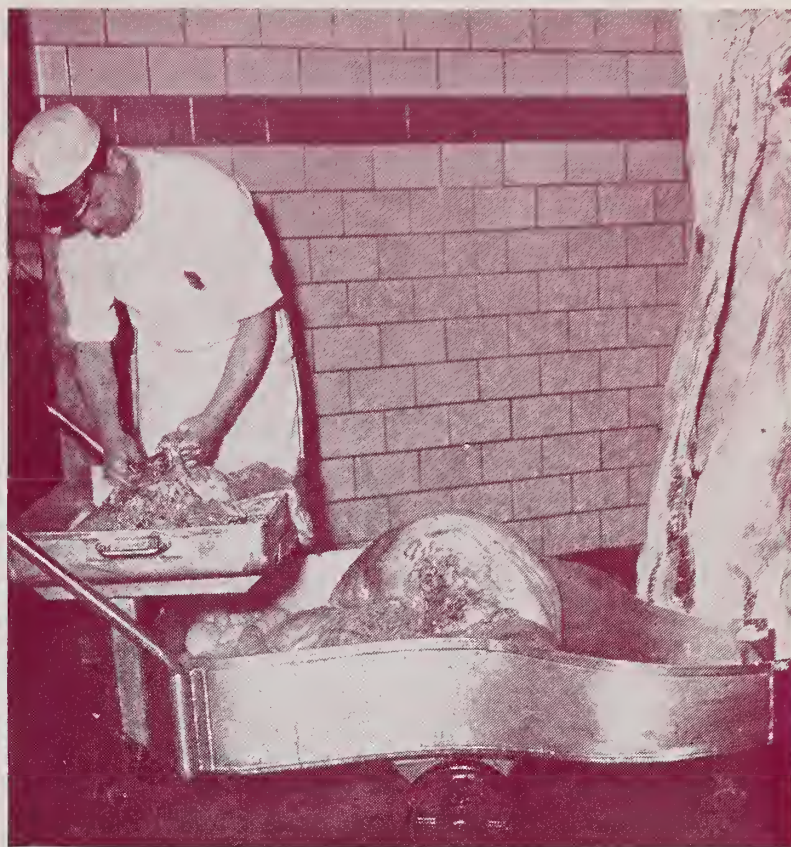
**5.** In this frozen-meat processing plant, inspector checks on cleanliness of containers and ingredients put in them, method and equipment in processing, adequacy of cold or heat treatment. Increasing variety of products makes ever-greater demands on inspection staff.



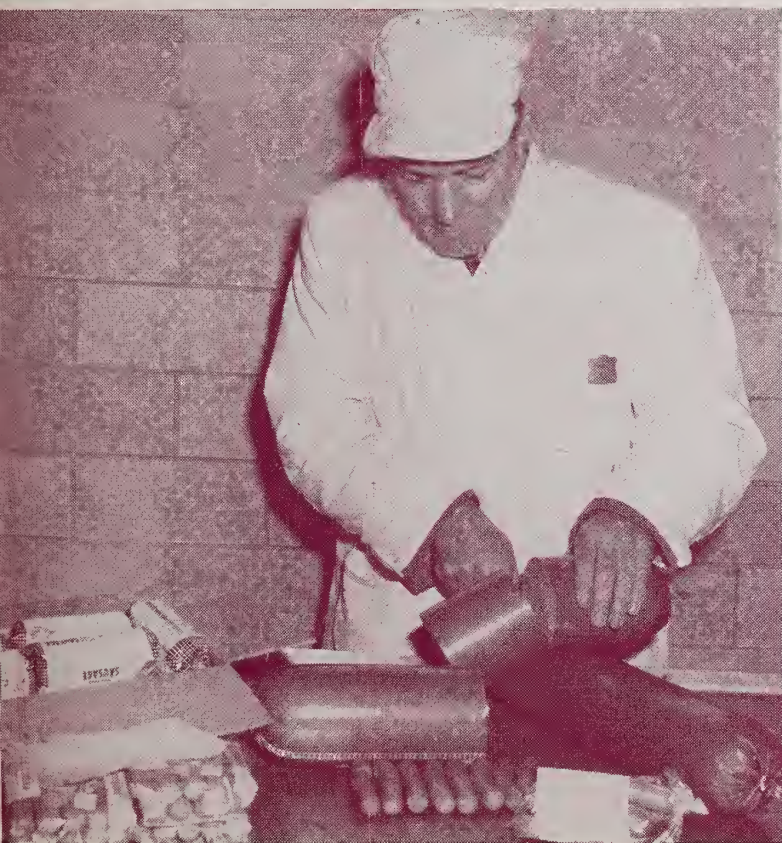
**2.** Before slaughter, Federal inspector examines animals carefully in pens near plant. He passes healthy ones, separates and tags those unfit for food or needing attention. Most of them are healthy, but over 50 conditions may keep animals or carcasses from getting past.



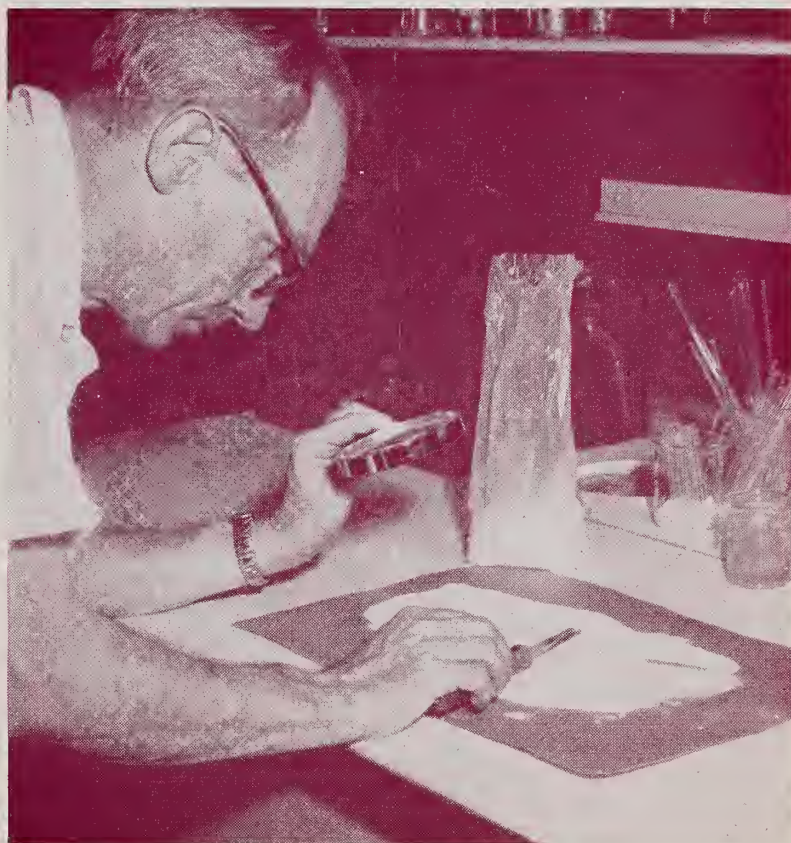
**3.** After slaughter, inspector carefully examines each animal's head, glands, internal organs, and finally the entire carcass. Any part that looks unsound is tagged "U. S. Retained," may be condemned if found unfit for food on further examination by veterinary inspector.



**5.** Samples of meat food products, separate ingredients, containers or wrapping materials used in packing and processing are picked up by roving inspectors from time to time. The samples are sent to the nearest of seven regional laboratories for chemical, other testing.



**7.** Laboratory tests are made to make sure all ingredients are wholesome. Protein content, fat, moisture, proportions of other permitted substances are checked to see that product is truthfully labeled. Container lacquers, coatings, wrapping materials are tested.



material; (6) supervision of marking and labeling of meat and meat food products; (7) maintaining laboratories to obtain chemical, bacteriological, pathological, and zoological information needed by inspectors.

**Fifty years ago, meat was inspected** in 163 plants in 58 cities. Today, inspectors work in about 1,200 plants in nearly 500 cities and towns. With the current trend toward decentralization of the industry and the introduction of new meat-processing methods and products, the number of plants to be serviced is increasing.

Here is a sampling of the volume of work done by the meat-inspection staff in one year: inspected the slaughtering of over 100 million meat animals and the preparation of over 16 billion pounds of canned, frozen, or otherwise processed meat and meat products; reviewed the drawings and specifications for sanitation for 911 new or remodeled packing plants; passed on more than 40,000 new labels or sketches for proposed labels.

Federal meat inspection is financed by the Government, except that packers reimburse USDA for the cost of providing overtime services. When Theodore Roosevelt submitted the Meat Inspection Act to Congress in 1906, he

said the cost of the service would not exceed 8 cents an animal. The cost today is less than 15 cents—equivalent to about 5½ cents in terms of the buying power of a 1906 dollar and well under the original estimate.

Consumer confidence developed over a half century of Federal meat inspection not only assures our people of a high standard of nutrition but also provides farmers with a continuing market for their most important product.

Farmers are helped, too, in keeping their herds healthy. Through the findings of meat inspectors and their research connections, destructive diseases are promptly diagnosed and traced to herds of origin. Farmers are notified in time to prevent the diseases from spreading. Meat inspection's part in disease eradication is reflected in the progressively lower percentage of animals that are found unfit for food. This is now down to about one-fourth of 1 percent of the animals federally examined.

Federal meat inspectors are in a strategic position in the event of biological warfare against our food supply. In daily contact with a large cross section of our meat animals, inspectors can detect unusual conditions and alert the country to prompt defensive measures.★



## FEDERAL MEAT INSPECTION THEN AND NOW



**HIGH STANDARD** of cleanliness set for federally inspected plants has led the way to improved construction and materials, better equipment and work techniques in meat packing. In a hog-killing plant of 1906 (left) much of construction was of absorbent wood;



metals took constant polishing; light, ventilation, plumbing, drainage were poor. In a similar plant today (right) modern steel construction is found; glass-block walls, fluorescent lights, tiled surfaces, stainless-steel equipment are used; there's hot water and good drainage.



fruits and  
vegetables

# Now we can get at

# SWEETPOTATO CORK VIRUS

**A quick, positive test that exposes this sneak root ruiner  
will help us move ahead with breeding resistant varieties**

**R**ESearch has removed a technical roadblock and may have a clear track to move against serious internal cork virus of sweetpotatoes.

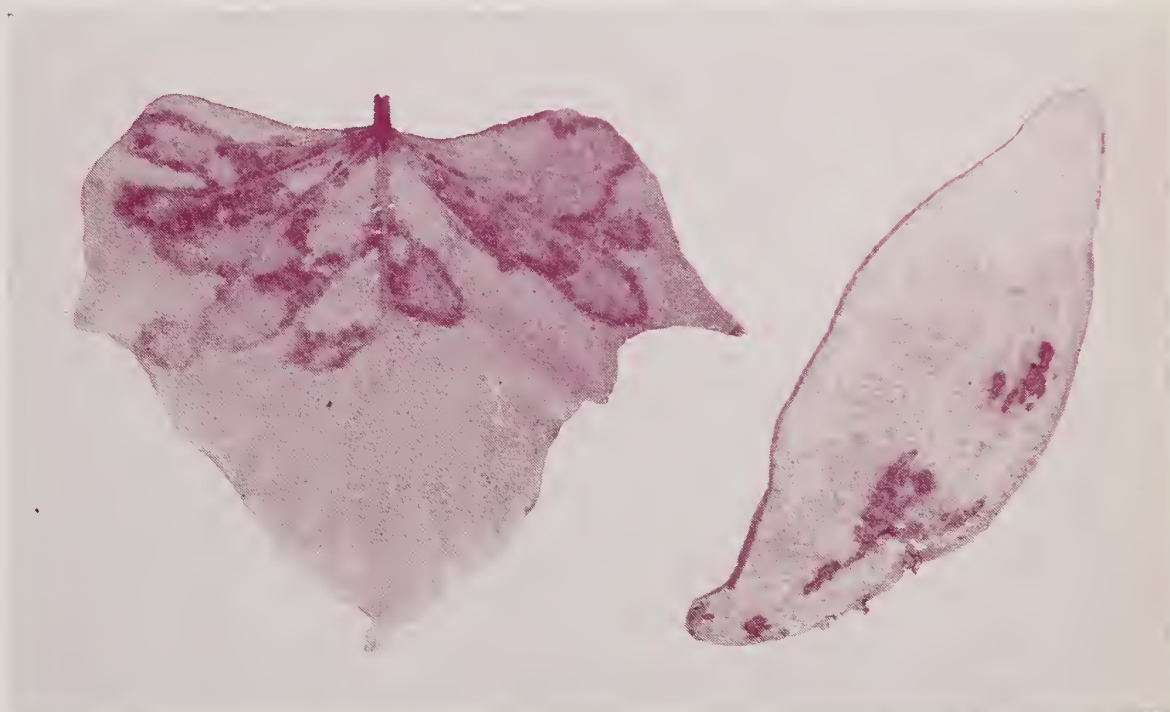
USDA plant pathologist E. M. Hildebrand at the Agricultural Research Center, Beltsville, Md., recently found a quick, positive way to check plant breeding lines and commercial varieties for the virus and find whether any of them is immune or resistant to the disease. He does it by transferring juice from the potato plant to the Scarlett O'Hara morning-glory, which soon shows signs of the disease if it was present in the potato. No disease symptoms in the morning-glory, no cork virus in the sweetpotato, as a rule.

This test should expedite the breeding of resistant varieties.

Internal-cork-virus disease has been known in this country since 1944 and may have been here before that. It apparently may be found wherever sweetpotatoes are grown, although it has little effect on some varieties. It is particularly destructive of the popular Porto Rico.

The disease attacks the entire plant but is most serious when it produces dark-brown to black corky tissue in root flesh. This makes potatoes undesirable or worthless.

**One insidious feature** of the disease is its obscurity. Often it is not evident until the root has been cut open. That means corky roots can be marketed at wasteful expense without exposing their unfitness until they are on the dinner table. Cannerymen are



**VIRUS INFECTION** may not show typical leaf spot (left) or root cork (right), but the plant juice inoculated into virus-sensitive Scarlett O'Hara morning-glory causes sure signs.

particularly troubled, since the roots may look normal when cooked or canned whole but show up defective when they are cut or broken open.

A hopeful sign, on the other hand, is the indication that Hildebrand and his associates have a few experimental lines of sweetpotatoes that appear immune or substantially resistant to internal cork. With the new test, these and all commercial varieties can be reliably checked. These experimental lines don't meet industry's needs but may provide the resistance factor to breed into desirable types. That hope is, of course, some years away from realization.

The virus generally becomes evident first in pale, chlorotic bands along the veins of the leaves. The

most serious effect is in the abnormal tissue produced in the roots. This root symptom doesn't necessarily show up by harvest time. It develops, if at all, largely during storage. It's favored by temperatures of 65° F. or higher. And infection may advance for nearly a year.

**Heretofore, the best** virus test called for grafting a root plug of the sweetpotato in question on the root of the highly susceptible Puerto Rico variety of sweetpotato. That takes a year to reveal virus symptoms and even then often isn't reliable.

So Hildebrand tried a modification of an inoculation method worked out by C. E. Yarwood at the University of California. Hildebrand macerates sweetpotato tissue in a solution



**VIRUS-SENSITIVE** Scarlett O'Hara morning-glory is readied for successful inoculation. Buffer spray, carborundum coat on leaf aid gentle wounding, air-free transfer of inoculant, and quick healing.



**ROLLED LEAF** from suspected sweetpotato plant is rubbed gently over morning-glory leaf to inoculate it. Carborundum cuts surface cells, juice from leaf roll enters cells, and wound heals instantly.

of cysteine, an amino acid, and inoculates the juice into the morning-glory. Cysteine apparently prevents instantaneous destruction of the virus on contact with air—preserves it long enough to establish the cork-virus disease in the new host plant.

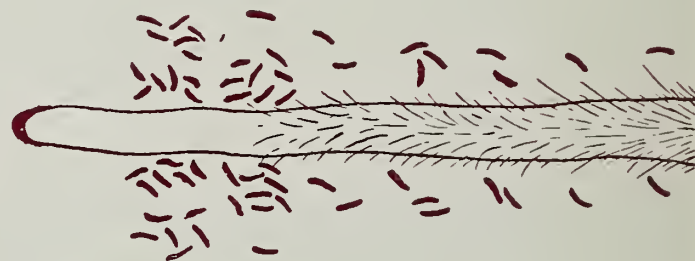
The researcher was highly successful in transmitting virus this way. Best of all, Scarlett O'Hara shows unmistakable all-over chlorosis within about a week if the disease is there.

Virus ordinarily must remain within plant cells or within the body of a carrier animal (insect) to transfer from one plant to another and survive. Hildebrand kept this virus viable as long as 2 hours with cysteine. That might be enough time to study the chemical nature of this disease-producing protein substance.

**It's interesting that** cysteine, the virus preservative, is an amino acid, a building block of proteins. The

cork virus seems to keep its essential regenerative function going by robbing host plants of their chemical building blocks to manufacture more of its own kind of protein. The virus uses or destroys chlorophyll in the plant leaf, creating pale or colorless bands along the leaf veins. Unlike living disease organisms, viruses lack the power of metabolism and must, therefore, depend on the metabolism of living hosts for survival.★

## Why Nematodes Attack



■ **THE ROOT-KNOT NEMATODE**—tiny “threadworm” or “eelworm” parasite of plants—likes some mysterious substance that occurs just back of the growing root tip of the tomato.

W. Wieser, research fellow assigned by the Foreign Operations Administration to study with USDA nematologists, found that the attraction is apparently due to something secreted where the root is growing rapidly by cell elongation.

In studies at the Agricultural Research Center, Beltsville, Md., Wieser laid young tomato seedlings on moist sterile sand and placed 2 nematode egg masses opposite each and at a distance of 5 millimeters (about one-fifth inch). After 24 hours he

counted nematodes that had migrated to various points along the root. He found a greater-than-average concentration at some places, less than average at others. If the plant had no stimulant, distribution should have been uniform. In other tests, nematodes reacted about the same way to segments cut from corresponding positions on the root.

Wieser found root-knot nematodes extremely sensitive to something associated with position on root and growth rate of root. Nematodes were actually repelled from the tip or terminal 2 mm. of the root. That's where growth takes place by *rapid cell division*—not *cell elongation*. Moreover, it takes a healthy plant and

active root growth to stimulate the parasite either way.

The attraction begins just about 2 mm. from the root tip, builds up for the next 6 to 9 mm., and maintains that strong pulling power for about double that length of root. Older cells in this root section are enlarging along the entire attractive portion of the root—are increasing the bulk of root tissue. That causes the plant's most active growth.

**Wieser thinks the** kinds of metabolism in the tip cells (where cell division takes place) and back of the tip (where cell enlargement occurs) are responsible for the secretion of stimulants—a repellent substance at the tip, an attractant along the adja-

cent 20 mm. or more of root. And whatever the attractant is, it's apparently secreted in proportion to metabolic activity. Wieser found that the number of nematodes attracted to any part of the root is proportional to the rate of growth of the root—ranging from slight attraction at a growth of 2 mm. in 24 hours up to a maximum sustained attraction, with only a little variation, from 8 to 21 mm. growth in 24 hours.

Wieser made some progress toward finding a chemical treatment that would drive nematodes away from plants. He observed some repulsion in tomatoes that were treated with the chemical MOPA (alphamethoxyphenylacetic acid). This compound acts as a systemic on beans, is absorbed and moved through the plant (AGR. RES., October 1953, p. 13).

**Applied to the tomato** stem at the second set of true leaves, MOPA reversed the tomato's root stimuli toward the root-knot nematodes. The part of the root that usually attracts nematodes actually repelled them when the plant had been treated. And the 2-mm. tip of a tomato root, which ordinarily repels the nematodes, didn't induce any particular reaction when the plants were treated.

Although Wieser didn't prove that MOPA was absorbed and moved to the tomato root in true systemic fashion, he did show that it leads to some disturbance that reduces the root's attractiveness for the root-knot nematodes. Unfortunately, MOPA harms the tomato, so he'll have to search further for a usable chemical.

What are the attractants and repellants in tomatoes? Do other plants secrete the substances or other kinds of them? And what do they do for the nematode, if anything, beyond stimulating its reactions? These are questions that call for further research. Once we have the answers, we will be that much closer to ways of controlling this costly pest.☆



## BARTLETT PEARS ...

## BETTER AND

## EARLIER

■ CALIFORNIA BARTLETT PEARS ARE POPULAR in the East when they first reach market each July. This fruit may be ready several days earlier, and of better quality, due to cooperative studies by USDA, the California experiment station, and Pacific Fruit Express Co.

The key is reduced icing to let fruit ripen partially in transit.

Bartlett pears ripen too fast and are subject to spoilage if shipped without refrigeration at summer temperatures. So heavy icing has been the practice, and that prevents any ripening during the 8-day to 10-day transit period. Thus, the pears must be ripened after arrival at market, taking 6 to 9 days. In hot weather, quality is poor unless special ripening rooms are used. It's costly to ripen fruit that way.

Bartletts have poor quality when ripened at temperatures above 80° F. They ripen most rapidly at 72° to 74° but have the best quality when ripened at 66° to 68°. They ripen very slowly at 45° to 50° and do not ripen at all at the usual transit temperatures below 40°.

Agricultural Marketing Service horticulturist A. L. Ryall and associates worked out some plans to ripen the fruits partially in transit from California. The methods depend on icing in correct amounts and at the right times. Here are some alternative modified-icing plans that have been found successful in fan-equipped refrigerator cars:

**When pears are loaded at below 75° F.**, half-stage icing under railroad perishable protective tariff Rule 247 allows some ripening in transit. This calls for icing the refrigerator car after loading, then re-icing on the fourth, sixth, and seventh days. Half-stage icing under Rule 254 also gave satisfactory results. That calls for preicing, replenishing the ice after loading, and re-icing on the fourth and sixth days.

Loading when temperatures are well above 75° F. requires that re-icings must be timed differently. The car should then be re-iced under Rule 247 on the third, fifth, and sixth days in transit, or re-iced under Rule 254 on the fourth, sixth, and seventh days.

Pears should be precooled to 40° to 45° F. to ship in nonfan cars.

Pears shipped under these recommendations will arrive in eastern markets still firm. But since some of the ripening process will have taken place, they'll soon be ready for eating. One company has shipped several hundred cars of Bartletts this way with full satisfaction.

The new plans will give consumers Bartletts several days earlier and ripened under conditions favoring highest quality. Marketing should be more orderly, too. The more mature second picking, which ripens quicker at market, won't compete with slow-ripening early fruit.☆



## Eating Well ALL YEAR



**Many families still find it healthful and profitable  
to raise and preserve food at home**

**D**O FARM homemakers still find it worthwhile to produce and preserve food, considering labor and the cost of equipment and fuel today?

The thrifty farm household has always produced a large share of its food supply and preserved as much as possible of the harvest to use throughout the year. And now—even with fresh and commercially preserved food readily available—home production and preservation of food is still a common practice on farms.

USDA survey of 528 farm households in 12 North Central States showed that they produced nearly half (retail-value basis) of the foods they ate during the year. Much of the home-produced food was meat and milk, which have a high price value and are less apt to be purchased if incomes are low. Also interviewed was a sample of 624 rural nonfarm families in the same region. They consumed a little less (retail-value basis) than farm families and produced only 7 percent of their food.

**The farm homemakers** canned or froze an average of 761 pounds of food in 1951, rural nonfarm families

273 pounds. Practically all the farm families did some canning, and three-fourths of them froze some food, using either home freezers or rented lockers in commercial plants.

Frozen meat, poultry, or fish made up almost half—or 340 pounds per household—of the total food canned or frozen on farms. Most of this came from home-grown animals, but many families bought additional beef or pork to freeze. Most of the 59 pounds of meat and poultry frozen by nonfarm families was purchased.

Most families, farm and nonfarm, preserved vegetables and fruits by canning or made them into jellies, jams, or pickles. Little was frozen.

The amounts of food canned as revealed by this survey were compared with the amounts reported by homemakers in a 1935–36 study. About the same proportion of farm families in both periods did some canning, but in 1951 the quantities canned were smaller. The amount of food frozen in 1951 (especially meat and poultry) was, of course, much greater.

Availability of electricity, freezers, and lockers is one reason for the large

number of families freezing food. As more and more homes are electrified and farmers can purchase freezers, more food may be frozen in preference to other methods of preservation. The ease of freezing, good quality of the product, convenience, and the fact that meats frozen raw can be cooked in any way desired—all these advantages make this method popular.

**ARS food economists** M. Orshansky, E. C. Blake, and M. A. Moss found that education, income, and age are related to food-preservation methods chosen. College-trained homemakers in this study were more apt to freeze food than women with less education. Women between the ages of 30 and 49 did more freezing, as well as canning, than those older and younger, probably because homemakers in this group have larger families to provide for. Families with high incomes more often had freezers or lockers than other families, therefore froze more food. The average was 548 pounds per household in farm families with over \$4,000 income and 254 pounds in families under \$2,000.

Well-planned home food production and preservation can reduce cash expense for some families, and a good supply of food on hand will provide a hedge against a drop in income. Moreover variety enlivens menus.

**Better nutrition** is another reward. As families produce their own meat, milk, fruits, and vegetables, and preserve as much of this food as possible for year-round use, they tend to eat better than families that purchase all of their food from the store.

The forthcoming USDA Agriculture Information Bulletin "Food Expenditures, Preservation, and Home Production, by Rural Families in the North Central Region, 1951–52" gives details on some of the survey findings. A second report on this study will deal with foods consumed during a week in the spring and the nutritive value of the family diets. ☆

## MORE DEPENDABLE WAY TO FIND OFF-FLAVOR



■ A NEW SINGLE-SAMPLE taste test has been developed by USDA scientists at the ARS Western Utilization Research Branch, Albany, Calif. This method should be especially useful in determining the effect of agricultural chemicals on food flavor.

Recent introduction of new organic insecticides has intensified the perennial problem of off-flavors in food products. Some of these materials leave a pronounced unpleasant flavor in crops; other materials produce only slight or no off-flavor.

The single-sample taste method was worked out to overcome certain defects of various direct-comparison tests. Take the triangle-difference method—a commonly used test in which the judges try to identify the odd sample among three presented at once. One trouble with this method is that the odd sample may identify itself by some difference in appearance or flavor unrelated to the question at issue. Another difficulty is that some kinds of off-flavor are apparent only as unpleasant after tastes.

The single-sample method reduces the severity of these problems by

avoiding direct comparison between treated and untreated samples.

This method is based on the assumption that a foreign flavor is of no consequence if tasters who have been selected for sensitivity can't detect it when making a series of single, adequately spaced tests in which treated and untreated samples are presented at random. Such a method is more positive for the detection of off-flavors distinguished by a lingering after taste, or those that quickly fatigue the taste buds, than direct comparison methods.

The material studied in the comparison tests was apple juice. Some lots of juice were made from apples sprayed during the season with the chemical demeton to control aphids.

In the single-sample taste method, the tasters were given as much as they wanted of only one sample at each test. Time between tests was at least 3 hours. The tasters were told that the treated samples were from fruit receiving certain spray treatments and would be presented at random with untreated ones. As each juice sample was presented, the tasters

were asked to indicate whether a foreign flavor was present and to describe the flavor if possible.

This test did not involve guessing, as might be true in selecting the odd sample in a triangle-difference test. The sample either *did* or *did not* have a foreign flavor to the taster, and the foreign flavor was indicated only if it was positively detected.

Single-taste tests were run during two successive seasons. Results showed that although some tasters found no foreign flavor in juice from demeton-sprayed apples, a substantial number could pick it up regularly and considered it objectionable. Triangle-difference tests of the same samples were inconclusive as to the presence of a foreign flavor.

One taster had demonstrated his ability to detect demeton-induced flavor consistently in a single-sample test. But he failed to identify the odd sample in 3 out of 4 triangle tests. Delay in detecting the off-flavor and its persistence after tasting were considered to account for the inability of sensitive tasters to identify the odd samples of this apple juice.☆



## IMPROVED METHODS FOR HOME FOOD CANNING

■ QUICKER AND EASIER ways to home-can foods while retaining fresh flavor and texture—these are the objectives of food preservation research.

USDA scientists and cooperators at the Texas and Massachusetts experiment stations in recent years have obtained new information on heat penetration into foods and resistance of spoilage organisms to heat. Canning investigations in both public and commercial laboratories have also supplied new basic information.

These findings, incorporated in revised canning directions, will appear in a revision of USDA Home and Garden Bulletin 8, "Home Canning of Fruits and Vegetables." Since it won't be available in time for early-summer canning, the information has been given to State Extension specialists, universities, and colleges.

ARS scientists still emphasize that nonacid vegetables require processing in a steam-pressure canner. Fruits, tomatoes, and pickled vegetables may

be canned in a boiling-water bath. In general, canning procedures have not changed, though some of the processing times have been revised.

The raw-pack method for canning fruits and vegetables helps preserve their natural flavor and shape. The cold, raw food is put into containers and covered with boiling water, juice, or sirup, or packed without added liquid. Raw-pack procedures for a number of fruit and vegetables will be included in the new bulletin. ☆



## agrisearch notes



**CONTOUR** plowing and planting have given increasingly better yields than plowing and planting up and down hill during a lengthy USDA study on steep slopes of central New York. A number of crops yielded up to a fifth more on contour by the 13th year.

Loss of plant nutrients through erosion is a big reason for the poorer showing of the up-and-down plots, soil conservationist G. R. Free believes. He has noted a much better growth of grass where the eroding soil accumulates below the up-and-down plots—nearly four times as much grass there in a 1951 test as below the contoured plots.

Water conservation is an objective of contour cropping. A 1953 test showed more moisture in most of the contoured soils—but not significantly more.



**FIVE NEW ANTIBIOTIC** weapons against plant diseases have proved effective against important fungus diseases of vegetables.

The chemicals—oligomycin, anisomycin, Mycostatin, griseofulvin, and Filipin—were tried with encouraging results against rust and anthracnose diseases of snap and dry beans and downy mildew and stem anthracnose of lima beans. Plant pathologist W. J. Zaumeyer and horticulturist R. E. Wester made the findings at USDA's Agricultural Research Center. The study will be extended to other plant diseases.

Oligomycin, at the rate of 100 parts per million parts of water, was toxic to each of the four fungus diseases. Anisomycin, at 50 parts per million, protected beans from rust and lima beans from downy mildew—at 100 parts per million, practically eradicated rust from plants infected with it for as long as 96 hours prior to treatment.

A dilute spray of Mycostatin protected snap beans and dry beans against anthracnose and partially against rust. That spray also partially protected limas against downy mildew. Griseofulvin protected beans from rust. Filipin gave limas good protection on downy mildew, snap beans and dry beans partial protection against anthracnose.

Mycostatin is in medical use, but the others are in experimental use only. Griseofulvin is a growth product of a species of *Penicillium*, relative of the mold fungus that yields penicillin. Others are produced by different species of *Streptomyces*, the genus of mold fungi that provide streptomycin. Thus, these fungus-produced chemicals combat the growth of other fungi—ones causing plant diseases.

Few antibiotics have proved effective against plant diseases.

**TREES GROW FASTEST** when they have enough "elbow room." In a south Arkansas study, Forest Service researchers thinned a 9-year-old loblolly-pine stand from 1,100 trees to the rather sparse stand of 100 trees per acre and tested the area for root distribution. Well-developed root systems reached just a little over 3 feet from the tree at that time and covered less than 10 percent of the area.

When the reduced stand was rechecked 2 years later, roots had expanded about as much as the tops had, and covered about 30 percent of the total area.

The roots were located with moisture meters that indicated where water was being removed rapidly. Water removal meant root activity and plentiful roots.





